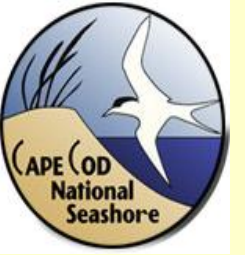




Nekton Response to Estuarine Restoration, East Harbor Truro MA



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Site Description and History

East Harbor is a 720-acre wetland is comprised of three sub-basins, Moon Pond, East Harbor Lagoon and Salt Meadow (Figure 1). The system originally included a tidal lagoon (East Harbor Lagoon) and extensive fringing salt marsh habitat (Moon Pond and Salt Meadow). The system has been artificially isolated from the Cape Cod Bay marine environment since 1868 when the original 1000-ft wide inlet at the northwest end of the system was filled. The exclusion of tides caused salinity to decline from a likely native condition of 25-30 ppt. to nearly freshwater conditions—at least by the time of the first documented fish survey in 1911. By this time the native estuarine fauna were largely extirpated; the State Survey of Inland Waters (1911) recorded “German carp and very few eels and shiners”



An oxygen depletion and fish kill in September 2001, involving about 40,000 alewives (*Alosa pseudoharengus*), originally introduced in the late 1960s, and several hundred white perch (*Morone americana*), prompted consultation between Truro, Cape Cod National Seashore and state officials on possible measures to improve water quality. As an interim measure, the clapper valves in the 4-ft diameter drainage pipe connecting the south end of the system (Moon Pond) with Cape Cod Bay were opened in December 2001 to try to increase aeration by partially restoring some tidal exchange.

As part of a multidisciplinary monitoring approach, the response of nekton to tidal restoration, and the subsequent increase of salinity from ~5 ppt to 20ppt was examined..

Methods

The East Harbor system is a challenging system to quantitatively sample. The combination of various habitats (e.g., tidal creek, freshwater marsh) and rapid changes in vegetation and algal communities made the use of a single sampling method impossible. A variety of active and passive methods have been tested over the last four years:

Throw traps—the main method used to sample nekton was a 1-m² x 0.5-m-high throw trap, with a 3-mm mesh and an aluminum angle-iron frame throw trap, deployed in creeks and along the edge of East Harbor Lagoon using. Workers carefully approached the sample site and tossed the trap, then removed any animals with a 1-m x 0.5-m dip net (1.5-mm



Beach seine—A 10-m seine with 3-mm nylon mesh was used in the East Harbor system

Minnow and crab traps—Minnow traps are 40 cm long with a diameter of 20 cm; mesh size is 5 mm with an opening of 2.5 cm. Crab traps are 75 m x 40 cm x 40 cm with a mesh size of 2 cm and a opening of 15 x 10 cm.. Bait was not used.

Cast net—A two-meter diameter cast net, with one-centimeter mesh size was used to sample in the parts of the East Harbor Lagoon with depth > 0.5 m.



Figure 1. East Harbor Salt Marsh Restoration Site with sub-basins indicated

Results and Discussion

In most of the East Harbor system, there has been an increase in the number of nekton species, especially the common estuarine species, e.g., *Fundulus heteroclitus* (Figure 2). Before the reintroduction of tidal flow, there were few nekton species present: carp, white perch, alewife and American eel. By number of species has nearly doubled (Table 1).

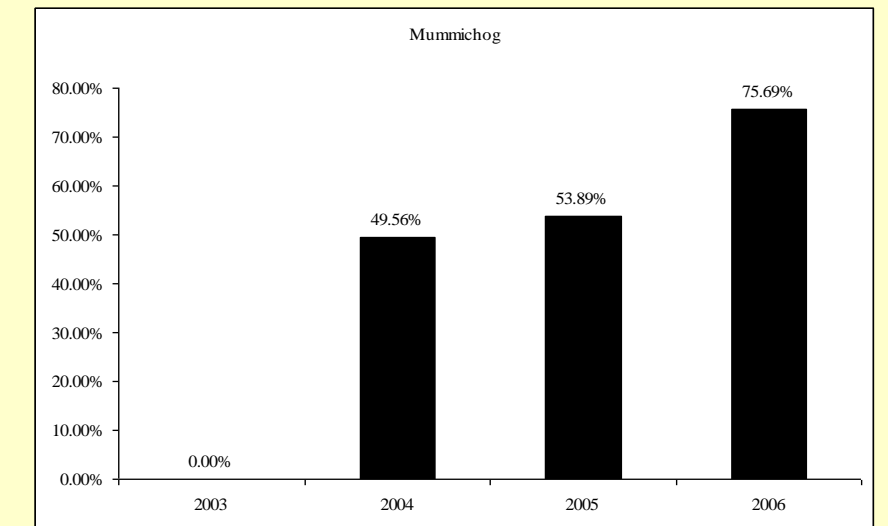


Figure 2. Increase in relative abundance of mummichog in East Harbor Lagoon 2003 to 2006.

Additionally, there have been interesting shifts in species at Moon Meadow; the shore shrimp (*Palaemonetes spp.*) was initially sampled in high densities. As the habitat in the tidal creeks changes from fine bottom to a more coarse sandy bottom, the sand shrimp (*Crangon septemspinus*) has become more common (Figure 3). The increase in the number of species and relatively stable densities indicates that the system is suitable habitat for typical estuarine species assemblages, a situation that is expected to improve with further restoration efforts.

Conclusions

The finfish of East Harbor lagoon comprised white perch, American eels, an introduced run of alewives, some killifish (*Fundulus heteroclitus*) and exotic carp prior to the recent partial restoration of tidal exchange and salinity. Reintroduction of tidal flow and salinity into the East Harbor Lagoon and Moon Pond has resulted in the rapid colonization by estuarine nekton species. Former fresh to brackish species have been replaced by an assemblage of nekton species typical of lower Cape salt marshes. The reintroduction of tidal flow and salinity is having a positive effect on the nekton community by providing habitat for spawning, as a nursery area and for feeding

COMMON NAME	East Harbor Lagoon				Moon Pond				Salt Meadow			
	2003	2004	2005	2006	2003	2004	2005	2006	2003	2004	2005	2006
American eel	X	X	X	X	X						X	
Atlantic silverside	X	X	X	X	X	X	X	X				
Brown bullhead									X		X	X
Crab species							X					
Four-spine stickleback		X	X	X							X	X
Golden Shiner									X		X	
Green crab		X	X	X	X	X	X	X				
Longnose spider crab							X					
Mummichog		X	X	X	X	X	X	X	X			X
Nine-spine stickleback			X	X	X		X				X	X
Pipe fish		X	X	X		X		X				
Sand shrimp	X	X	X			X	X	X				
Shore shrimp	X	X	X	X	X	X	X	X				
Spider crab species						X						
Striped killifish				X								
Three-spine stickleback				X								
White perch	X	X	X	X			X		X			X
Winter flounder	X		X				X	X				
Total number of species	6	9	11	11	6	7	10	7	4		5	5

Table 1. Species occurrence in the three sub basins of the East Harbor system

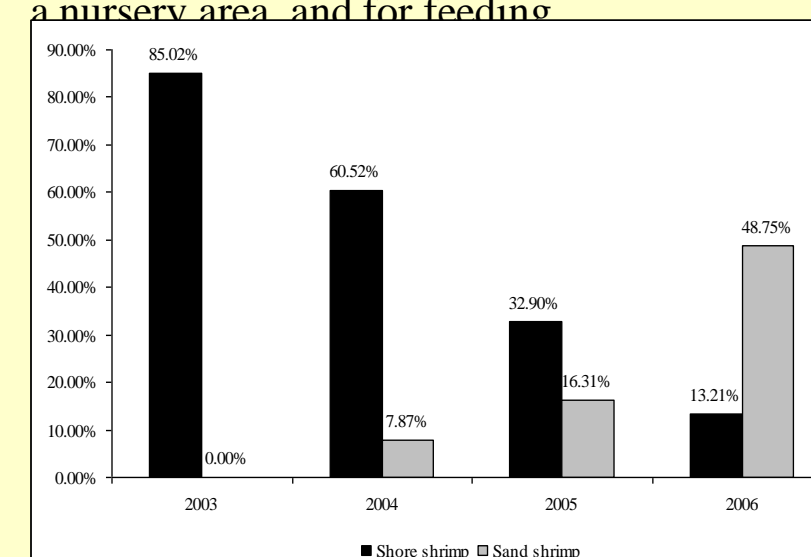


Figure 3. Relative abundance of shore shrimp and sand shrimp in Moon Pond marsh 2003 to 2006

The Future at East Harbor

- Continue to monitor nekton annually in the East Harbor system.
- Test new methods to increase effectiveness of monitoring in the East Harbor system. These may include cast nets, lift nets and extensive use of minnow traps and other passive methods in Salt Meadow and the East Harbor Lagoon.
- Work with ecologist to understand the nutrient dynamics of the system and impact on the nekton community.

